The Pituitary Hormones

The Pituitary Glandis the main gland (Queen of gland), it is a small gland found in the base of the Brain in a cavity called Sellaturcica and it is divided in to two portions **Anterior** and **Posterior pituitary gland.**

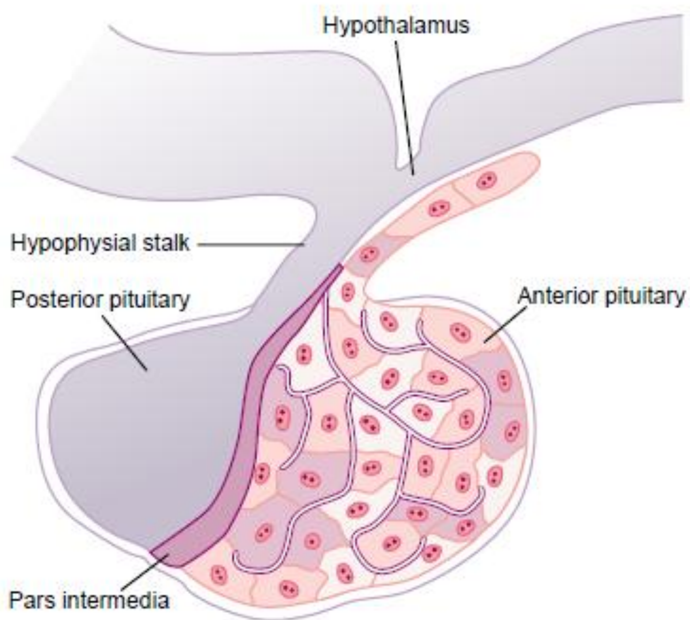


Figure 75–1

Pituitary gland.

The Hormones secreted by the Pituitary gland there are 6 Hormones secreted by the **Anterior portion** and Hormones secreted by the **Posterior portion**.

The Hormones secreted by the **Anterior portion** are:

1. Growth Hormone.
2. Thyroid Stimulating Hormone (TSH) also called Thyrotropin.
3. Adrenocorticotropic Hormone (ACH) also called Corticotropin.
4. Prolactin.
   - Functions in association with female Sexual Hormones Estrogen and Progestrone for the development of Breast in the female and formation of milk during Pregnancy.
5. Follicular Stimulating Hormone (FSH).
6. Leutinizing Hormone (LH).
   - FSH and LH they control the growth of sexual glands (Male testis and Female ovaries) and their Hormonal activities. The sex Hormones are secreted by the **Anterior pituitary gland**.

Posterior Pituitary gland secretes two Hormones they are:

1. ADH (Anti-Diurteic Hormone).
2. Oxytocin.

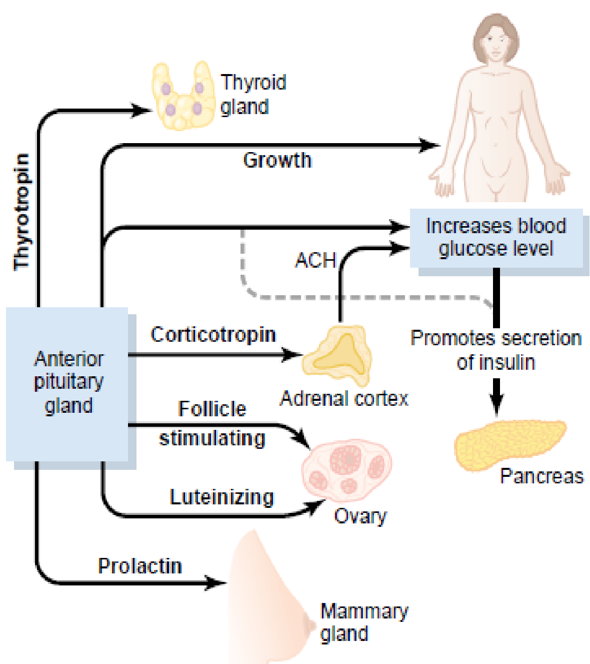


Figure 75–2

Metabolic functions of the anterior pituitary hormones. ACH, adrenal corticosteroid hormones.

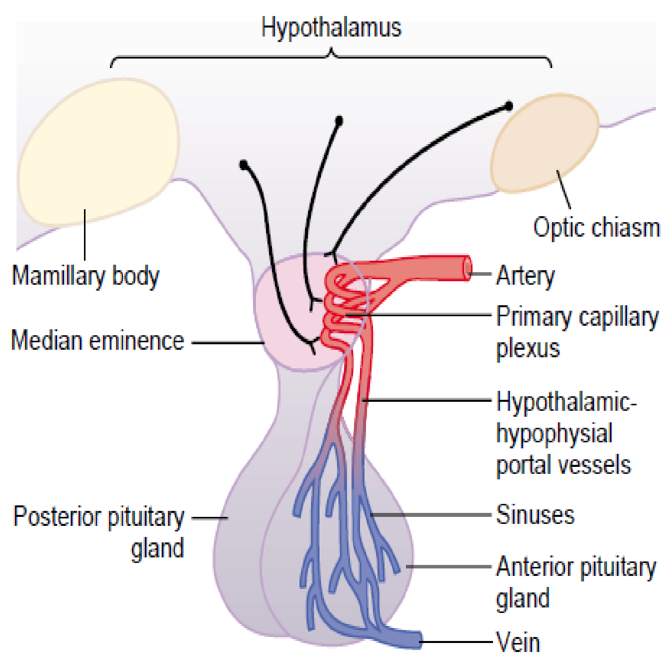


Figure 75–4

Hypothalamic-hypophysial portal system.

The Hormones of **Anterior Pituitary gland** portion are regulated by factors released from the Hypothlamus the **Hypothalamic releasing factors** and **Hypothalamic**

inhibitory factors and these factors pass the **Anterior pituitary gland** portion through very small blood vessels

called**Hypothalamic – Hypophyseal portal vessels.**Whereas the posterior Hormones are regulated by nerve signals sent from the Hypothalamus to the posterior pituitary gland.

Table 75–3

Factors That Stimulate or Inhibit Secretion of Growth Hormone

Stimulate Growth Hormone Secretion	Inhibit Growth Hormone Secretion
Decreased blood glucose	Increased blood glucose
Decreased blood free fatty acids	Increased blood free fatty acids
Starvation or fasting, protein deficiency	Aging
Trauma, stress, excitement	Obesity
Exercise	Growth hormone inhibitory hormone (somatostatin)
Testosterone, estrogen	Growth hormone (exogenous)
Deep sleep (stages II and IV)	Somatomedins (insulin-like growth factors)
Growth hormone–releasing hormone	

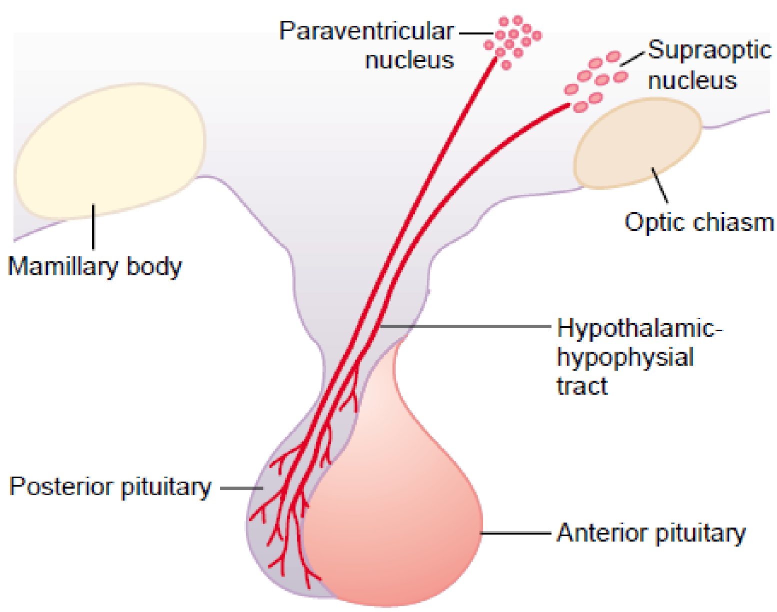


Figure 75–9

Hypothalamic control of the posterior pituitary.

We can see from the figure 75-9 nerve fibers originate in the posterior pituitary gland so posterior pituitary hormones are regulated by nerve signals originated from the Hypothalamus.

Now Let's talk about the **Growth Hormone**. It has :

1. General effect.
2. Metabolic effect.
3. Effects on Bone and Cartillage.

General effects of **Growth Hormone** it increases the sizes of the cells and mitosis of cells.

Metabolic effects of **Growth Hormone** it increases protein synthesis and mobilization of fatty acids from Adipose tissues so will lead to release of fatty acids to the circulation this will lead to increase of the concentration of fatty acids and increase the use of them for production of energy. It also decreases the rate of Glucose utilization by the cells.

Effects on Bone and Cartillageit first decreases protein synthesis in Bone cells (Osteogenic cells) and Cartillage (Chondrocytic cells). It also stimulate the conversion of Chondrocytes to Osteocytes so it will lead to deposition of new Bone. It also increases the reproduction of these cells.

The effects of **Growth Hormone** on Bone and Cartillage is not direct, it is suggested that it is not direct effect but indirect effect because **Growth Hormone** causes mainly the liver to secrete small proteins called**Somatomedins** mainly **Somatomedin**s – C. These **Somatomedins**especially **C** causes the effects of **Growth Hormone** on Bone and Cartillage.

How the lengthening of long Bones occur ?the long Bones consist of **Epiphysis** and **Diaphysis** and an **Epiphyseal plate**. This **Epiphyseal plate** is formed of proliferating cartilage. How lengthening occurs? The cartilage cells in **Epiphyseal plate** convert to Bone cells on the **Diaphyseal side** so it means deposition of new Bone and so the lengthening of Bone occurs.

When the growth of Human completes at that time the **Epiphyseal plate** have been converted to Bone and so **No Lengthening** after that will occur we call this condition **Fusion of Epiphysis.**

The normal concentration of **Growth Hormone** is very small and this concentration decreases with Age.

	ng/ml
5 to 20 years	6
20 to 40 years	3
40 to 70 years	1.6

But concentration of **Growth Hormone** throughout the day is not constant there is **Biorhythmical Variations** as you see from figure 75-6 there is **Biorhythmical Variations** throughout the day.

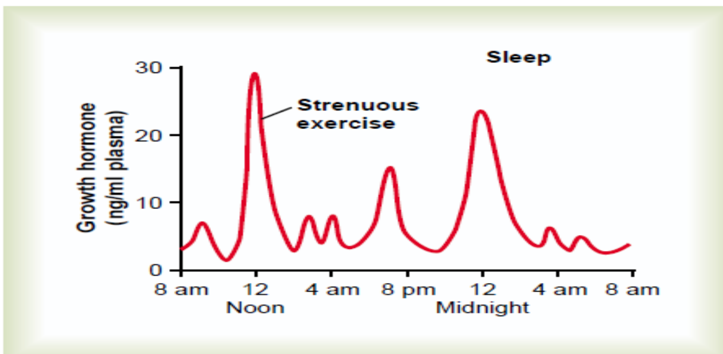


Figure 75–6

Typical variations in growth hormone secretion throughout the day, demonstrating the especially powerful effect of strenuous exercise and also the high rate of growth hormone secretion that occurs during the first few hours of deep sleep.

You can see here during the first hours of deep sleep it increases and throughout the day there are variations (**Biorhythmical Variations)**. Also there are some factors that can stimulate the **Growth Hormone** secretion like:

1. Exercise.
2. Deficiency of Proteins, Glucose and Fatty acids.
3. Excitement.
4. Trauma.

Now we will talk about the abnormalities of **Growth Hormone** secretion. It can occur deficiency of **Growth Hormone,** if deficiency occurred during Childhood this will lead to **Dwarfism**. If the deficiency only of **Growth Hormone** this dwarf his sexual functions are

normal so these dwarfs can reproduce because deficiency is only of **Growth Hormone** we call these dwarfs **Physiological Dwarfs**.

But if the deficiency is of all **Anterior pituitary gland** hormones the sexual functions in these dwarfs are not normal so they cannot reproduce we call this condition **Panhypopituitaries**, These dwarfs we call them **Asexual Dwarfs**.

Sometimes the **Growth Hormone** is normal but there is hereditary inability to form **Somatomedins**especially **Somatomedins C**, also these persons are dwarfs and this case we call them **African Pigmy**pigmy also means dwarf.

We talked about the deficiency of **Growth Hormone** what about excessive production of **Growth Hormone**?

Excessive production of **Growth Hormone** could be before **Fusion of Epiphysis** or after **Fusion of Epiphysis**. The person will be Giant we call this case **Gigantism.**

Part of these giants will have **Diabetes Mellitus** why? Because of the decreased Glucose utilization they will have **Hyperglycemia** because of the **Over-activity** of **Beta cells** in pancreas this may lead to degeneration of **Beta cells**.

If excessive production of **Growth Hormone** occurs after **Fusion of Epiphysis** would he be a Giant?

No because there is NO lengthening of the Bones because of **Fusion of Epiphysis.** What will really happen is that the Bone increases in thickness and so may happen enlargement or increase of growth of soft tissues this case we call it **Acromegaly**.

The Thickness of the bones increases and growth of soft tissues so will lead to enlargement of Bones of **Hands, Forehead, Supraorbital ridge** and **Lower jaw** also soft tissues may enlarge such as **Tongue, Liver and Kidney**.

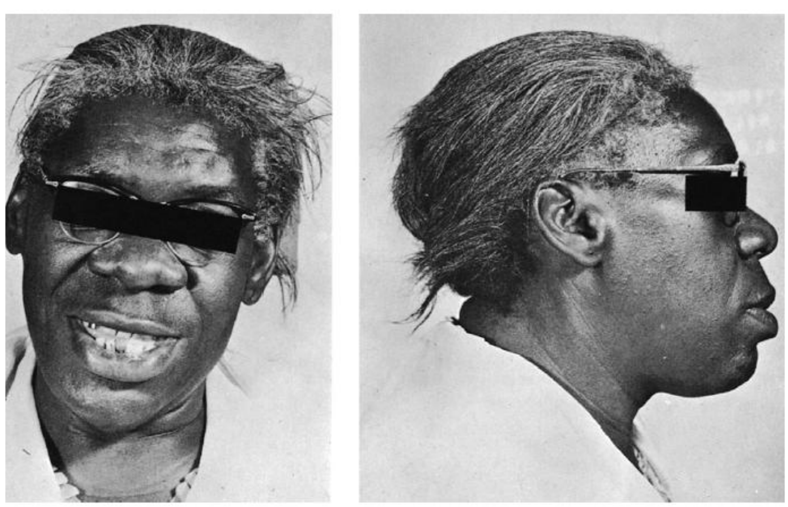


Figure 75–8
Acromegalic patient.

Now we move to **Posterior pituitary gland** Hormones two Hormones:

1. ADH
2. Oxytocin.

ADH is a famous hormone we studied about it in different systems. It functions in **Reabsorption** of water in Renal distal tubules.

Small concentrations of **ADH** causes this effect **Reabsorption of fluids** in Renal tubules but high concentrations of ADH causes constriction odArteriorles so ADH has another name **Vasopressin**.

The other Hormone is **Oxytocin** causes contraction of the pregnant uterus toward the end of Gestation because during delivery of the baby stimulation of the Cervix occur. Signals to the Hypothalamus stimulate the secretion of **Oxytocin** so it will happen contraction of the pregnant uterus and lead to delivery of the baby. Another function of **Oxytocin** when the baby is sickling the Nipple of the Breast of his mother signals are transmitted to the Hypothalamus to stimulate secretion of **Oxytocin** so **Oxytocin** will lead to contraction of Myoepithelial cells surrounding the Alveoli of the Breast (The breast of the lactating mother). In less than a minute the milk ejection will Happen.

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